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LOW ENERGY STEREO-SELECTIVE EPOXIDATION OF TRANS-STILBENE: SHAPE SELECTIVE HETEROGENEOUS CATALYSIS USING MORPHOLOGY CONTROLLED MIXED METAL OXIDES

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Morphology controlled $LaVO_4/Cu_2V_2O_7$ mixed metal oxide has been synthesized via a hydrothermal process using oleic acid/oleylamine (OL/OA) surfactant mixture and studied for stereo-selective epoxidation of trans-stilbene into cis-stilbene oxide in a low energy pathway. Surfactants have the ability to adhere to certain facets of the nanocrystals that can govern the growth rate and prevent particle agglomeration. Material synthesized in the presence of OL/OA mixture was composed of monodisperse nanocrystals. The material was characterized by powder X-ray diffraction, FE-SEM, EDX, nitrogen physisorption experiments, and TG-MS. The gas chromatography – mass spectroscopic (GC–MS) method was used for the quantitative analysis and identification of the reaction product. Stereo-selective epoxidation of trans-stilbene was carried out under low energy conditions with 100% selectivity. According to GC–MS results, trans-epoxide was formed as the initial product, however, with the course of the reaction, it was completely converted into cis-epoxide confirming that the catalyst shows 100% conversion and selectivity at 60 °C. Since no byproducts are formed, the atom economy is 100%. As trans-epoxide was also formed during the reaction, desired stereo-chemical product can be isolated by controlling the reaction time. The cooperative effect of the surfactants was further validated with a series of experiments with no observation of 100% cis-epoxide selectivity confirming that the OL/OA ratio has a great influence on the product selectivity. The reaction was truly catalytic showing only a 22% conversion after 21 hours without the catalyst and a very high reusability giving a 92% conversion and 100% selectivity even after the 4th cycle. There is no evidence on heterogeneous catalysts which convert trans-stilbene into cis-epoxide with 100% selectivity at a comparatively low temperature as 60 °C. Therefore, this could be considered as a novel, low energy, environmentally benign, hence a highly sustainable green process.

Keywords: Catalysis, Energy, Epoxidation, Stereo-selective, Sustainable